

VOL. VI, NO. 127-128, PLS. 7, 8

JUNE 22, 1904

THE
NATIONAL GEOGRAPHIC MAGAZINE

THE BATTLE OF THE FOREST

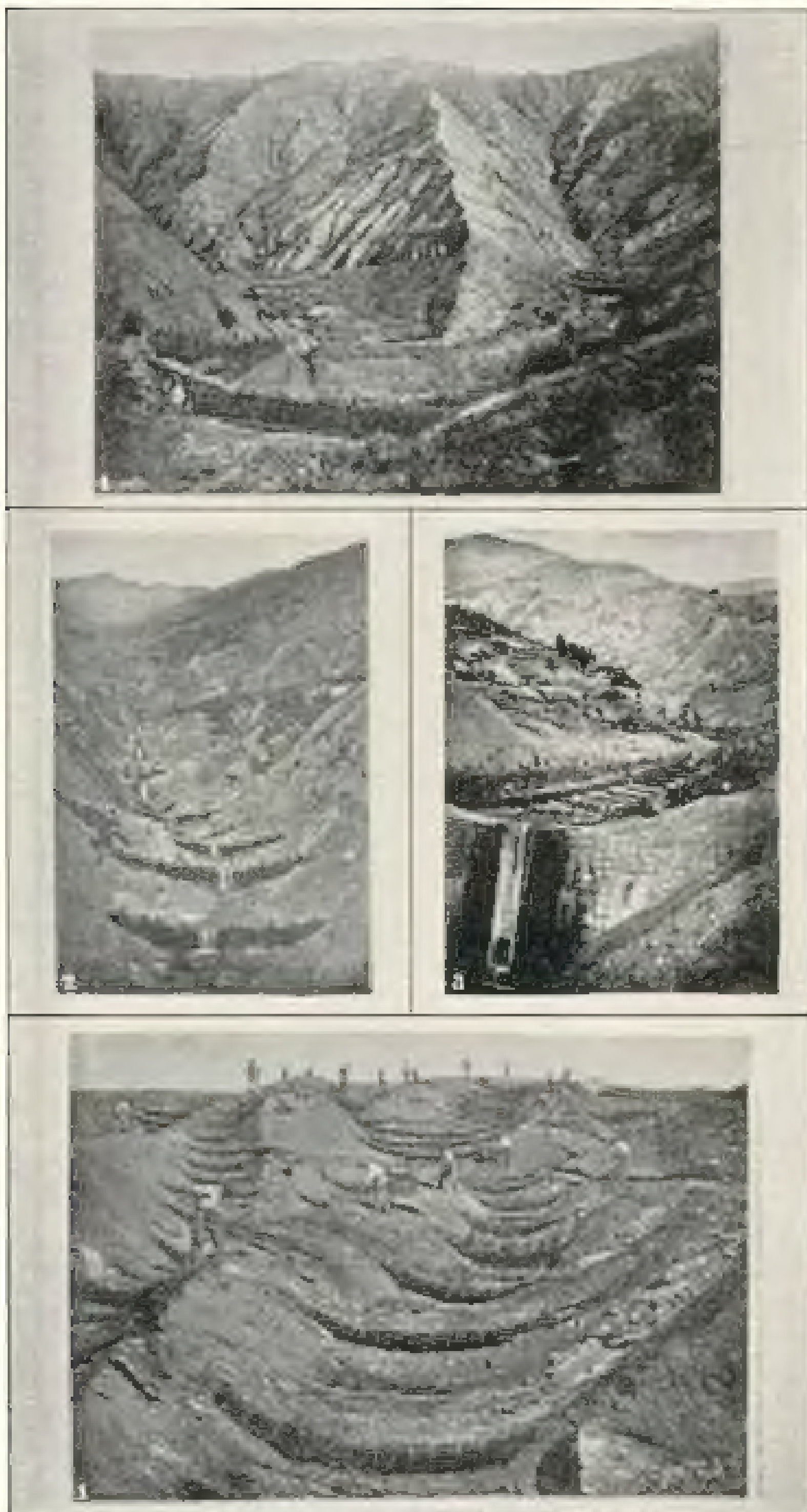
R. E. FERNOW



WASHINGTON

PUBLISHED BY THE NATIONAL GEOGRAPHIC SOCIETY

Price 25 cents



BROWNING THE TOMBENT.

1. View of the river valley.
2. View of the river valley.

3. View of the river valley.
4. View of the river valley.

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NATIONAL GEOGRAPHIC MAGAZINE

THE BATTLE OF THE FOREST

BY

R. E. VERNOW

(Presented before the Society December 15, 1883)

The earth is a potential forest. Given time, freedom from geologic revolutions and from interference by man, and tree-growth must finally dominate everywhere, with few excepted localities.

Its perennial nature and its elevation in height above all other forms of vegetation, together with its remarkable recuperative powers, assure to the arborescent flora this final victory over its competitors.

So impressed was Dr Ann Gray with the persistence of individual tree life that he questioned whether a tree need ever die: "For the tree [unlike the animal] is gradually developed by the successive addition of new parts. It annually renews not only its buds and leaves, but its wood and its roots; everything, indeed, that is concerned in its life and growth. Thus, like the fabled Aesculapion, being restored from the decrepitude of age to the bloom of early youth, the most recent branchlets being placed by means of the latest layer of wood in favorable communication with the newly formed roots and these extending at a corresponding rate into fresh soil, why has not the tree all the

conditions of existence in the thousandth that is possessed in the hundredth or the tenth year of its age?

"The old and central part of the trunk may, indeed, decay, but this is of little moment so long as new layers are regularly formed at the circumference. The tree survives, and it is difficult to show that it is liable to death from old age in any proper sense of the term."²

However this may be, we know trees succumb to external causes. Nevertheless they are potential enough to outlive might else. "To be the oldest inhabitants of the globe, to be more ancient than any human monument, as exhibiting in some of its survivors a living antiquity compared with which the towering relics of the earliest Egyptian civilization, the pyramids themselves, are but structures of yesterday." The dragon trees, so called, found on the island of Tenerife, off the African coast, are believed to be many thousand years old. The largest is only 1½ feet in diameter and 75 feet high. Our sequoias are more rapid growers and attain in 3,000 to 4,000 years, which may be the highest age of living trees, more than double these dimensions.

While this persistence of life is one of the attributes which in the battle for life must count of immeasurable advantage, the other characteristic of arboreal development, its elevation in height above everything living, is no less an advantage over all competitors for light, the source of all life. Can there be any doubt that in this competition *size* must ultimately triumph and the undersized go to the wall?

Endowed with these weapons of defensive and offensive warfare, forest-growth, through all geologic ages during which the earth supported life, has endeavored and no doubt to a degree succeeded in gaining possession of the earth's surface.

As terra firma increased emerging in islands above the ocean, so increased the area of the forest, changing in composition to correspond with the change of physical and climatic conditions.

As early as the Devonian age, when but a small part of our continent was formed, the mud flats and sand rocks, ever increasing by new accumulations under the action of the waves and currents of the ocean, were changed from a bare and lifeless world above tidelevel to one of forest-clad hills and dunes.

²Longevity of Trees: "Scientific papers of Asa Gray" (selected by Chas. Sargent), vol. 2, 1883, p. 71.

Not only were such quaint forms as the tree rushes or *Calamites*, *Lepidodendron* and *Sigillaria* present, but the prototype of our pine, the *Dicksonia*, had made its appearance.

The same class of flowerless plants known as vascular cryptogams, with the colossal tree forms added, became more numerous and luxuriant in the Carboniferous age, as well as the flowering *Sigillaria* and coniferous *Dicksonia*. This vegetation probably spread over all the dry land, but the thick deposits of vegetable remains accumulating in the marshy places under dense jungle growth and in shallow lakes with floating islands, were finally in the course of geologic revolutions, turned into the great coal fields.

In these and subsequent geologic times some of the floral types vanished altogether and new ones originated, so that at the end of Mesozoic times a considerable change in the landscape had taken place.

In addition to coniferous trees, the palms appeared, and also the first of angiosperms, such as the oak, dogwood, beech, poplar, willow, saucer and tulip trees. Species increased in numbers, adapted to all sorts of conditions; the forest in a most varied and luxuriant form climbed the mountain sides to the very crests, and covered the land to the very poles with a flora of tropical and semi-tropical species.

Then came the levelling processes and other changes of post-Tertiary or Quaternary times; the glaciation of lands in northern latitudes, with the consequent changes of climate, which brought about corresponding changes in the ranks of the forest, killing out many of the species around the north pole. Only the hardier races survived, and these were driven southward in a veritable rout.

When these horrid times subsided in a degree, the advance of the forest was as sure as before, but the battle order was somewhat changed to suit the new conditions of soil and climate. Only the hardiest tribes could regain the northernmost posts, and these found their former places of occupancy changed by fluvial and lacustrine formations and the drifts borne and deposited by the ice-sheets, while some by their constitution were entirely unfit for engaging in a northern campaign or found insurmountable barriers in the refrigerated east-west elevations of Europe and western Asia.

In addition, there had come new troubles from volcanic erup-

them, which continually wrested the reconquered ground from the persistent advance guards of the arboreal army, annihilating them again and again.

Finally, when the more settled geologic and climatic conditions of the present era arrived and the sun arose over a world ready for human habitation, man found what we are pleased to call the virgin forest—a product of long continued evolutionary changes—occupying most, if not all the dry land, and ever intent upon extending its realm.

This prehistoric review of the battle of the forest cannot be left without giving some historic evidences of its truth.

Not only have paleobotanists unearthed the remnants of the circum-polar flora, which give evidence that it resembled that of present tropic and semi-tropic composition, but they have also shown that sequoias, magnolias, liquidambars and hickories existed in Europe and on our own continent in regions where they are now extinct. We have also evidences of the repeated successes and reverses of the forest in its attempts to establish itself through long geologic transformations.

One of the most interesting evidences of these vicissitudes in the battle of the forest is represented in a section of Anethysat mountain in Yellowstone National Park, exhibiting the remains of fifteen forest-growths, one above the other, buried in the lava. Again and again the forest subdued the inhospitable eruptions; again and again it had to yield to superior force.

Among these petrified witnesses of former forest glory, magnolia, oak, tulip tree, sweetgum, linden and ash have been identified, accompanying the sequoia in regions where now only the hardiest conifer growths of pines and spruces find a congenial climate.

As the forest formed and spread thus during the course of ages, so does it form and spread today, unless man, driven by the increasing needs of existence, checks its progress and reduces its area by the cultivation of the soil. This natural extension of the forest cover or afforestation takes place readily wherever soil and climate is favorable, but it is accomplished just as surely, though infinitely slower, in unfavorable situations. On the naked rock, the coarse detritus and gravel beds, on the purely siliceous sand deposits of river and ocean, or in the hot dry plains, the preliminary pioneer work of the lower vegetation is required. Algae, lichens, mosses, grasses, herbs and shrubs must

pioneer to cultivate the naked rock, to mellow the rough gravel beds, to make the soil, to increase the soil moisture by shading the ground and gradually render it fit for the abode of the forest monarch. The army of soil-makers and soil-breakers, the pioneers, as it were, of the forest, are a hardy race, making less demands for their support than those that follow. They come from different tribes, according to the soil conditions in which they have to battle. As soon as they have established themselves they begin their cultivatory activity, which consists in withdrawing from the rock or soil and from the air the nutritive elements, returning them to the soil when they die and decay, in a form much more suitable for the support of the higher plants. The nutritive elements and the physical properties of the soil are improved and augmented by the repeated growth and decay of these pioneers, in that the soil is deepened and made mellow and its capacity for moisture increased. The waters charged with carbonic acid derived from the decay of the vegetal matters hasten the decomposition of the underlying rock, and the fertile soil layers increase until more fastidious plants can subsist. The humblest workers, alga, lichens, cacti and mosses, are followed by sedges, dry grasses, herbs and shrubs, or in the drier climates by agaves and yuccas. Then come the succulent grasses and herbs, gradually covering the soil with a meadow or prairie, the shrubs become more numerous, by degrees closing up, shading the ground and overshadowing the grasses, and finally the time is ripe for the arborescent flora. Nor does then the forest appear at once in its fullness and variety of form. Single trees, stragglers or skirmishers in small numbers, and shrub-like and stunted forms first arrive, gradually increasing in number and improving in form. These by their shade and by the litter formed from the fall and decay of their foliage improve the soil for their betters to follow.

The aspen (*Populus tremuloides*) is one of these forerunners, which, thanks to its prolific production of light feathery seed, is readily wafted by the winds over hundreds of miles, readily germinates and rapidly grows under exposure to full sunlight, and even now in the Rocky mountains and elsewhere quickly takes possession of the areas which man has ruthlessly destroyed by fire. This humble and ubiquitous but otherwise almost useless tree is nature's restorative, covering the sores and scabs of the burnt mountain side, the baten poured upon grievous wounds.

Though short-lived, with its light summer foliage turning into brilliant golden autumn hues, it gives grateful shade and preserves from the thirsty sun and wind some moisture, so that the better kinds may thrive and take its place when it has fulfilled its mission.

One of the shrubs or half trees which first take possession of the soil in the western mountain country is the so-called mountain mahogany (*Cercocarpus ledifolia*) covering the bare slopes after the fire has killed the old timber.

In other regions, as on the prairies of Iowa and Illinois, hawthorn bushes; or in the mountains of Pennsylvania and the Alleghenies in general, ornamental shrubs like the laurel and rhododendrons or hawthorn, viburnum and wild cherry are the first comers, while along water-courses alders and willows crowd even the water into narrower channels, catching the soil which is washed from the hillsides and increasing the land area.

One of the most interesting soil-makers, wresting new territory from the ocean itself, is the mangrove along the coast of Florida. Not only does it reach out with its aerial roots entangling in their meshes whatever litter may float about and thus gradually building up the shore, but it pitches even its young forward into the advance of the battle, to wrestle with the waves and gain a foothold as best it may.

Not less interesting in this respect is that denizen of the southern swamp, the bald cypress with its curious root excrescences known as cypress knees, which, whatever their physiologic significance, are most helpful in expelling change of water into land sufficiently dry to be capable of supporting the more fastidious species in regard to moisture conditions.

In passing, the remarkable adaptation to diverse conditions of some of the tree species should be noticed, as it gives them significance as geographic factors. The trees of the swamp, or at least many of them, seem to indicate their independence of moisture conditions by the range of climate and soil in which they are found. In fact, they grow in the swamp, not because that is their most suitable locality, but because they can do so to the exclusion of other competitors. The bald cypress itself will grow in the dry soil and arid atmosphere of Texas and Mexico; the oak which associate with it in the swamp will occupy almost any soil and site; the sweet gum or liquidambar is found in similar places of Indiana. The juniper or red cedar,

[illegible][illegible][illegible]

1. 2017.01.01 - 2017.01.02

traced the two white paths and a remarkable feature in taking them was noticed, they are doubly difficult, as spaces but a few feet wide at any given point. One of the same is believed to be a new growth of a recently sprouted tree, and the other can be seen to be a sapling of a tree whose sprouts are being removed by the forest workers. The other is a young tree growing in a clearing.

In the early stages of life but little sunlight of most trees requires particularly and are quite content to grow in the shade. Some have such a tolerance of light that a shade of trees is to them a necessary condition of life, some are content to grow in full sunlight, and some of the most vigorous are found growing in the shade, but few are perfectly happy if the sun grows too strong for them, only a few of the best and strongest and of the highest of a particular kind can endure the full sun in midday.

As the shade of a forest grows up and as the forest itself grows level up, each trying to get as great a share of light as it can, the struggle becomes more and more desperate, and growth and struggle cease until only a few trees remain, having won by the process of elimination.

The struggle among the trees is never-ending, for as long as life exists on this earth, the struggle between the stranger and the old tree is never-ending. The old tree is always fighting for its life, and the stranger is always fighting for its life. The old tree is always fighting for its life, and the stranger is always fighting for its life. The old tree is always fighting for its life, and the stranger is always fighting for its life.

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I have been thinking up or thinking about part of the food and drink we eat realize that the very existence is a product of the geological, extending over centuries, nay, thousands of years. So we are in a position to appreciate what food we eat, what it cost us if we need to work for it. It is my hope that we are all so situated as to be grateful in our own

The largest of our stations, Forest, from a road having a rough, old
boarded driveway up to the top of the mountain of the same
type just noted, the steep rise of the hill and of the road to a
height of nearly one thousand feet, with a view
of the river and the hills beyond, and the view of the
mountain, all of which are of the same type of granite, except

[illegible]

Having thus arrived through the narrow throat of a narrow gorge at the foot of the high, steep forest, having seen some of the excellent plants in the struggle for existence, and having of the orchids and ferns, being the earth and on the other side, they took a look at the vegetation of the region, the North American continent, and the region. It was in the beginning of the day, and the sun was in the sky.

As far as our (quasi) scientific treatment of the (social) environment, we
 are still stuck with a single (and not very useful) parameter: the number



Figures 1 and 2, in showing of what total types are made. The first figure shows how, by the forest of tree kind change, the forest grows in its composition, all going far from being the most varied of the forest types, to becoming not by the influence of the human hand a more homogeneous and genuine arboreal forest, and by the

There is a great deal of evidence to show that the growth of the human body is not a simple process, but a complex one, involving many factors, and that the growth of the human body is not a simple process, but a complex one, involving many factors, and that the growth of the human body is not a simple process, but a complex one, involving many factors.

Young D. must have been from a place, perhaps including the well known one, where the Indians were known to go to the great rocks and leave the prey upon which animals feed, as it does in some places. From the back of the great corner of the half circle I just described, a portion of the upper corner of the half circle extension of the No. 2000 Form is exposed with a line extending from the line of crest on the west side of the No. 2000 to on the crest.

For most individuals and nations, the long years of the past century have been a journey to the west, from east to west, from the shores of the deserts of the region, with the high mountains and deep valleys of the west.

[illegible]

of those who have taken refuge in the forest. And by some have expected for the company of the wood to either to cultivate the crops or to undertake the work for hire which is not legitimate and justifiable practice, and have been deceived and have lost their share of wealth and property, and thereby have incurred for the benefit of some other persons a debt which is a stumbling block to the improvement of the country, of which we can obtain the superior benefit, and that the

great many and without doubt more than a way to the valley below. When the mountains are too steep and higher overworks are necessary, they are made of massive round logs at great expense. At the base of these overflow dams a opening is left for the water to drain through, even after the dry season when the rain and has turned to snow. In the winter the water has wasted down for a mile. Then, when the snow on the soil has come to rest forest planting begins, and gradually the forest is "drawn" a part of the soil. Sometimes a well up a slope from a lake so the taking back is made as soon as possible, and now necessary to carry the soil to the top of the hill or the rock, where the soil is some distance from the first hole, and they are stopped at the light to let the soil settle and make it more so. Generally the slope of the mountain is a little bit on a side but not so before the arrival of the soil and has sometimes, not only but, but also the great many more. The destruction of the forest, first for the purpose of the mountain, then the more and more of the valley the clearing for the use of the farm use, by excessive

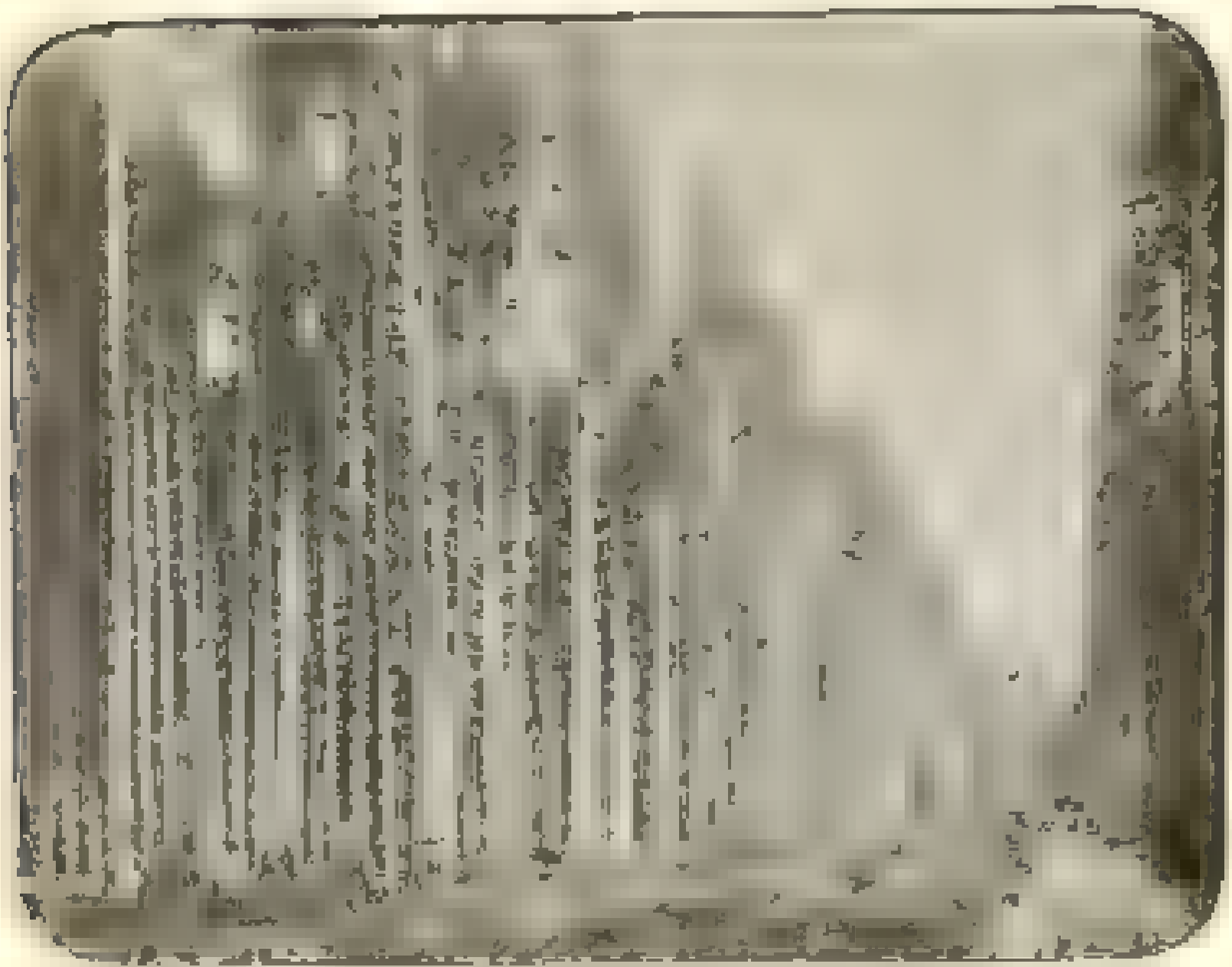
[illegible]

1. We are working in the field toward the same end as you well know to the near future. For the best reason, John Maynard or visit the coast of New England, New Jersey, Maryland, etc. and to that effect, and you can see the destruction of the different species of birds by a species of birds and in the plants over the entire Atlantic coast. The big houses of the country, and the vegetation of the Rocky Mountains, and the mountains of the West and the mountains with their trees.

This Motion, supported by a majority of the members of the Motion picture industry, is:

For example, when a person used the same device that a child always uses successfully, the user is more likely to have the plant with it or possibly to

[illegible][illegible]



The battle of the forest in this country is now fought by man, the intellects at and speedily carrying on a war of extermination, without the knowledge that their victory may lead eventually to their own destruction. The intelligent and provident trying to let the forest cover as much ground as possible to prevent the primary forest lands from being over a better, a person had to restrict the use of the machine to such, maximum harvest of the material, without the use of the machine and water conditions, as well as an ever-replenishing crop and a person at a distance to

We do not say that the progress of the earth as it exists here is about the only opportunity for the forest geography to shape the future of the earth, and even to be the extent of the forest and the population.

